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Causality Among Oil Prices, GDP and Exchange Rate: Evidence from Azerbaijan and Kazakhstan*

Mehmet Dikkaya**
Bayram Veli Doyar***

Abstract

Following their independence, Azerbaijan and Kazakhstan, which place great importance to oil industry, have also succeeded in attracting foreign investments to this industry. Over time, this industry, which has become a key to the economy, has made the economy vulnerable particularly to oil prices. In this regard, current paper investigates causal relationships between quarterly time series of oil prices, GDP and exchange rate for both Azerbaijan and Kazakhstan separately. Toda-Yamamoto causality test results for Azerbaijan suggest that there are unidirectional causalities from exchange rate to oil prices, from oil prices to GDP and from GDP to exchange rate. As for Kazakhstan, causalities run from oil prices to GDP, exchange rate to GDP and oil prices to exchange rate.

Keywords

Azerbaijan, Kazakhstan, Oil Prices, GDP, Exchange Rate, Causality

JEL Classification: C32, F31, Q43, F43

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** Prof. Dr., Kırıkkale University, Department of Economics - Kırıkkale/Turkey
mdikkaya@kku.edu.tr

*** PhD Student, Kırıkkale University, Department of Economics - Kırıkkale/Turkey
bvdoyar@gmail.com

INTRODUCTION

After collapse of the Soviet Union, the question of how to secure the financing of economic transformation in the former socialist countries of the union has great importance. When we consider Central Asian and Caucasus regions were less developed than the other regions, the solution of this problem became more vital. Because of this underdevelopment, countries of the region, particularly against political and economic fluctuations, have shown a more fragile structure.

Azerbaijan and Kazakhstan attach importance to petrochemical industry in respect to economic transformation after gaining their independence. With the discovery of new oil reserves since 1990s, expansion of foreign investments in these two countries could be regarded as an important positive factor. In these countries, increasing oil investments made petrochemical industries key sectors of the economy thanks to their great improvement. In the years when oil prices were in a rising trend, as in other energy-dependent countries such as Russia, GDP growth in both Azerbaijan and Kazakhstan were much higher than other non-energy-rich former socialist countries.

This increase is a big income for budget and means a source of funds both for development of other branches of industries and modernization of economic infrastructure. However, the decrease in oil prices in late 2014 affected economic indicators of the countries through key sector energy. Because of sharp decrease in oil revenues of these countries, Kazakhstan has had to move to free foreign exchange regime, and Azerbaijan has been forced devaluation of national currency for twice. As in other countries, this view shows that how sensitive these countries to oil prices and high oil revenues. In this context, an econometric analysis of the economic indicators which are linked to oil prices have importance.

The purpose of current paper is to reveal causal relationships between oil prices, GDP and exchange rate for Azerbaijan and Kazakhstan. According to BP (2015) data, Azerbaijan had 42 million tones (share in world production 1%) and Kazakhstan had 80.8 million tones (share in world production 1.9%) production potentials in 2014. Also, the shares of oil revenues minus production costs in GDP's are 27.23% for Azerbaijan and 20.99% for Kazakhstan (theglobaleonomy.com, 2014).

Without exception between countries, energy in general, especially oil, has become an indispensable input for production and transportation with Industrial Revolution. Therefore, the interrelationship between oil prices and macroeconomic indicators is one of the topics discussed in detail consistently. As far as we know, there is no special work examining causal relationship between the variables afore mentioned for these countries. In this regard, we run Toda-Yamamoto causality tests after applying required unit root tests using quarterly oil prices, GDP and exchange rate (US Dollar) variables spanning 2001Q1-2014Q2 for Azerbaijan and 1994Q1-2015Q4 for Kazakhstan to make contribution to develop profiles of these economies.

The first section of the paper concentrates on macroeconomic effects of oil prices. The second section sums up related literature, the third section explains data sets and methodology and the fourth section presents and evaluates empirical results. The final section involves policy implications for both countries within the frame of analysis results.

1. OIL AND MACROECONOMY: A SHORT HISTORY

It is known that ancient communities attributed sanctity to fires burned with gas leaking from cracks, although it is not known when petroleum was first used. It was seen that asphalt was used to make boats waterproof and heat houses in the years about 6000 B.C. In 3000's B.C., it is put on the records that Egyptians used the asphalt in building pyramids, for medical purposes and mummification. Indians benefit from oil in making of waterproof canoes and war paintings (Fagan 1991: 2-1). Mankind has had to drill, since inefficient surface leaks did not satisfy the needs. Although the first commercial oil discovery was made by James Miller Williams in Ontairo in 1858, the birth of the US oil industry is the oil exploration that Edwin L. Drake made as a result of drilling in Pennsylvania in the following year (Fagan 1991: 2-2).

Before modern times, oil was used for primitive purposes. In the wake of Industrial Revolution, it's started to be used in machines and the prospect of oil in the global economy has increased over time. Such that, oil has the shares of 31.1% in primary energy supply and 39.9% in final energy consumption, according to 2013 data (IEA, 2015).

Ebrahim et al. (2014) state that the dependency on oil and its by-products leave global economy defenseless to various macroeconomic side effects. The authors explain that the volatilities in oil prices affect consumption, investment and industrial production directly; and inflation and unemployment indirectly. Accordingly, consumption will decrease in the face of the economic uncertainty created by volatility in oil prices. Because, decreasing consumer confidence triggers precautionary savings. When real investments are expected to decline in the short and mid-term due to the uncertainty about the profitability of investments and the expected decrease in demand, financial investments may increase or decrease depending on the level of market risk preference level. The production side will naturally react regarding firm decisions. Firms can maintain their production levels by raising their prices or can lower their production levels in response to declining demand. On the inflation side, there are both deflationary pressure caused by decreasing demand and inflationary pressure caused by increasing prices. Inflation may increase or decrease depending on which pressure is dominant. Unemployment level directly increases because of decreasing consumption and industrial production, or decreases as in Phillips Curve with expectations.

3. LITERATURE REVIEW

There is a vast amount of papers that examine relationships between oil prices and various macroeconomic variables for different countries and times with different econometric methods. We can summarize the literature as in Table 1, when we focus on the relationship between oil prices, exchange rate and GDP.

Results from these studies differs from in terms of the directions of causalities. For instance, Bal et al. (2015) and Pradhan et al. (2015) find bidirectional causality between oil prices and exchange rate. Brahmasrene et al. (2014), Öztürk et al. (2008), Bénassy-Quéré et al. (2007), Amano et al. (1998) and again Bal et al. (2015) show causality runs from oil prices to exchange rate. Also, Pradhan et al. (2015), Aliyu (2009), Akıncı et al. (2012) and Öksüzler et al. (2011) detect causalities from oil prices to GDP. Akıncı et al. (2012), again, show a causality running from GDP to oil prices. We can mention Yardımcıoğlu et al. (2013) among the works that find bidirectional causality between oil prices and GDP.

Table 1. *Literature on Causality for Various Countries*

Author	Country	Time	Methodology	Causality
Amano et al. (1998)	USA	1972:2-1993:1	Johensen-Juselius cointegration, Granger causality	OIL → EXC
Bénassy-Quéré et al. (2007)	China	1974-2004	Johansen cointegration, Granger causality	OIL → EXC
Öztürk et al. (2008)	Turkey	1982: 12-2006: 05	Johansen cointegration, Granger causality	OIL → EXC
Aliyu (2009)	Nigeria	1986Q1-2007Q4	Johansen cointegration, Granger causality	OIL → GDP EXC ↔ GDP
Öksüzler et al. (2011)	Turkey	1987: 01-2010: 09	VAR model, Granger causality	OIL → GDP
Akıncı et al. (2012)	OPEC and oil importer countries	1980-2011	Johansen-Juselius cointegration, Granger causality, random and fixed effects models	GDP → OIL (OPEC) OIL → GDP (Oil importer countries)
Yardımcıoğlu et al. (2013)	10 OPEC countries	1970-2011	Pedroni, Kao and Johansen Fisher cointegration tests, Canning and Pedroni causality tests	OIL ↔ GDP (L)
Brahmasrene et al. (2014)	USA	1996: 01-2009: 12	VAR model, Pedroni cointegration and Granger causality	EXC → OIL (S) OIL → EXC (L)
Pradhan et al. (2015)	G20	1961-2012	Panel VAR, VECM base Granger causality	OIL, MAC, EXC, INF and INT → GDP (L) EXC ↔ OIL (S)
Bal et al. (2015)	India and China	1994: 01-2013: 03	Linear Granger causality Nonlinear Granger causality Nonlinear Granger causality with GARCH	OIL → EXC (India and China) OIL ↔ EXC (India and China) OIL ↔ EXC (India) EXC → OIL (China)

A → *B* shows causality runs from *A* to *B*.

A ↔ *B* shows there is bidirectional causality between *A* and *B*.

S (short-run), L (long-run), OIL (oil price), GDP (GDP or economic growth), EXC (exchange rate), INF (inflation), INT (interest rate), MAC (market capitalization).

Besides these works, there are papers focusing on vector auto regression (VAR) models and elasticity estimation. For example, Narayan et al. (2008) find that an increase in oil prices increases exchange rate using generalized autoregressive conditional heteroskedasticity (GARCH) and exponential GARCH (EGARCH) models. Rautava (2004) applies Johansen cointegration test on quarterly data from 1995 to 2002 and finds a 10% increase in oil prices rises GDP and government revenues by 2.2% and 4.6% in the long-run, respectively. Akıncı et al. (2012), whose causality results are given on Table 1, use random and fixed-effects models to estimate elasticities. They find a 1% increase in oil prices rises GDP by 0.014% and 0.011% for OPEC countries, and decreases GDP by 0.001% for oil importer countries. Osigwe (2015) utilizes ordinary least squares (OLS) and two-stage least squares (2SLS) methods and finds increases in real exchange rate and oil prices positively affects Nigeria's economic performance. Güneş et al. (2013) test quarterly real exchange rate, terms of trade and world oil prices data from 1995 to 2010 using structural VAR method for Turkey. They find that a shock in world oil prices leads to a fall in real exchange rates and explains about 21% of the variations in real exchange rates. Basher et al. (2012) use monthly real oil prices, trade weighted exchange rate and real emerging market stock prices data for structural VAR model from 1988 to 2008. They show that positive shocks to oil prices depress exchange rates in the short-run. Also, a positive shock in real economic activity rises oil prices when increases in emerging market stock prices rise oil prices.

However, when we filter similar works for Azerbaijan and Kazakhstan, we are left with a limited literature. Among these, using Johansen and ARDL cointegration methods for 2000-2007 quarterly data, Hasanov (2010) shows a 1% rise in oil prices ends up with 0.7% increase in real effective exchange rate in the long-run for Azerbaijan. Error correction models derived from these two models show that deviation from the short-run equilibrium is corrected by 15-20% in the long-run. Kutan et al. (2005) use monthly data from 1996 to 2003 to show whether Kazakhstan suffers from Dutch disease, which is known as decline in total production when a country reaches a new source. Empirical results indicate that oil price changes increase the value of real exchange rate and Dutch disease symptoms. Also, using structural VAR model, Köse et al. (2015), points out that negative and positive oil price shocks affects industrial production in the same directions. They also find that exchange rate is affected by negative oil price shocks, not positive. Finally, they discover neither positive nor negative oil price shocks have effects on inflation in Kazakhstan.

3. DATASET AND METHODOLOGY

This section explains dataset and methodology. Two different unit root tests are utilized to see stationarities and we prefer relatively new causality test of Toda et al. (1995) rather than conventional Granger causality test.

3.1. Dataset

Brent oil prices (US Dollar) data obtained from Federal Reserve Bank of St. Louis web site is used. GDP in domestic currency sourced from IMF (2016) IFS database is converted to US Dollar using exchange rate obtained from the same source, which is also used as a different variable. Dataset for Azerbaijan consists of quarterly observations from 2001Q1-2014Q2, when for Kazakhstan 1994Q1-2015Q4.

At this point, it is useful to touch on the point that Cunado et al. (2005: 67) state on the selection of oil price variable:

> "The choice of oil price variables is difficult and, as we shall show later, important. National oil prices have been influenced by price-controls, high and varying taxes on petroleum products, exchange rate fluctuations (such as the important devaluations after the Asian crisis in most of the countries in our sample) and national price index variations. All the differential characteristics which influence the effective oil price that each of the countries face raise great difficulties in measuring the appropriate oil price variable for each country. Thus, most of the empirical literature which analyze the effect of oil price shocks in different economies use either the $US world price of oil as a common indicator of the world market disturbances that affect all countries or this world oil price converted into each respective country's currency by means of the market exchange rate. The main difference between the two variables is that only the second one takes into account the differences in the oil price that each of the countries faces due to its exchange rate fluctuations or its inflation levels."

Every variable is used in their nominal values (there are papers that use variables in their nominal values, e.g. Yavuz (2006) and Tuğcu (2014)). Since we have quarterly data, variables are seasonally adjusted using Census-X13 method. All variables are used in their natural logarithmic forms to decrease heteroskedasticity.

3.2. Methodology

Stationarity states of the series are examined using Augmented Dickey-Fuller (ADF) (Dickey et al., 1981) and Phillips-Perron (PP) (Phillips et al. 1988) unit root tests. Maximum integration order m_{max} obtained from these tests is needed to carry out the causality test in the next step.

We utilized from Toda-Yamamoto causality test (TY) developed by Toda et al. (1995). If an *X* variable is better in the estimation of a *Y* variable using all available information, then it is said *X* Granger causes *Y* (Granger 1969). Toda et al. (1995) show how to estimate VAR models that are formulated in their level values and how to test general constraints in parameter matrices, even if the processes are integrated or co-integrated at random levels.

To carry out this test, maximum integration degree of the variables m_{max} is found using unit root tests in the first step. Optimal lag length p is detected for VAR model with help of information criterias. Then a VAR model with $p+m_{max}$ lags is estimated. Wald test, which is asymptotically chi-square distributed, is applied on p lags to see whether the coefficients are statistically different from zero or not and the direction of causality is determined.

When p is the optimum lag length, m_{max} is the maximum integration order and u is white noise term, VAR model to be estimated for *OIL*, *GDP* and *USD* variables for TY procedure can be written as follows:

$$OIL_t = \alpha_0 + \sum_{i=1}^{p} \beta_{1i}\, OIL_{t-i} + \sum_{j=p+1}^{m_{max}} \beta_{2j}\, OIL_{t-j} + \sum_{i=1}^{p} \gamma_{1i} GDP_{t-i} + \sum_{j=p+1}^{m_{max}} \gamma_{2j}\, GDP_{t-j} + \sum_{i=1}^{p} \delta_{1i} USD_{t-i} + \sum_{j=p+1}^{m_{max}} \delta_{2j}\, USD_{t-j} + u_{1t} \tag{1}$$

$$GDP_t = \alpha_1 + \sum_{i=1}^{p} \theta_{1i}\, OIL_{t-i} + \sum_{j=p+1}^{m_{max}} \theta_{2j}\, OIL_{t-j} + \sum_{i=1}^{p} \mu_{1i} GDP_{t-i} + \sum_{j=p+1}^{m_{max}} \mu_{2j}\, GDP_{t-j} + \sum_{i=1}^{p} \rho_{1i} USD_{t-i} + \sum_{j=p+1}^{m_{max}} \rho_{2j}\, USD_{t-j} + u_{2t} \tag{2}$$

$$USD_t = \alpha_2 + \sum_{i=1}^{p} \tau_{1i}\, OIL_{t-i} + \sum_{j=p+1}^{m_{max}} \tau_{2j}\, OIL_{t-j} + \sum_{i=1}^{p} \varphi_{1i} GDP_{t-i} + \sum_{j=p+1}^{m_{max}} \varphi_{2j}\, GDP_{t-j} + \sum_{i=1}^{p} \omega_{1i} USD_{t-i} + \sum_{j=p+1}^{m_{max}} \omega_{2j}\, USD_{t-j} + u_{3t} \tag{3}$$

When deciding to direction of causality, for example for equation (1), the null hypothesis of which means "*GDP, Granger-causes OIL*" is tested using Wald test. Test results demonstrate that if the null is rejected, then the alternative hypothesis of $H_1: \gamma_{1i} \neq 0$ which means "*GDP does not Granger-cause OIL*" is accepted. Causal relationships among the other variables are tested in the same way.

4. RESULTS

This section presents results from unit root and causality tests for both countries separately. We identified mainly different causal relationships.

4.1. Results for Azerbaijan

Concerning ADF unit root test results given on Table 2, unit root hypothesis is rejected at 1% significance level for *OIL* and *GDP* variables in their first differences both for equations with constant and equations with constant and trend. *USD* becomes stationary at 1% significance level for equation with constant and equation with constant and trend only when the test is applied on its second difference.

Table 2. *ADF unit root test results (Azerbaijan)*

	ADF (Constant)			ADF (Constant and trend)		
	Level	1st dif.	2nd dif.	Level	1st dif.	2nd dif.
OIL	-1.576	-7.133***	-	-2.822	-7.078***	-
GDP	-1.195	-6.273***	-	-0.445	-6.367***	-
USD	-0.988	-2.784*	-2.697***	-2.913	-2.642	-6.529***

*** and * represent significance at 1% and 10%, respectively. Lag length for ADF test is chosen by Schwarz Information Criteria.

As seen on Table 3, results from PP unit root tests are parallel with ADF test results. When we consider all these outputs, maximum integration order is $m_{max}=2$ and thus, it is decided that the number of additional lags to be included in the VAR model to be estimated is 2.

Table 3. *PP unit root test results (Azerbaijan)*

	PP (Constant)			PP (Constant and trend)		
	Level	1st dif.	2nd dif.	Level	1st dif.	2nd dif.
OIL	-1.413	-7.748***	-	-2.952	-7.960***	-
GDP	-1.130	-6.294***	-	-0.720	-6.380***	-
USD	-0.320	-2.192	-5.613***	-2.411	-1.794	-6.351***

*** represents significance at 1% level. Barlett Kernel is used as the spectral estimation method and the bandwidth is determined using the Newey–West method.

Optimum lag length is found p=2 for the VAR model to be estimated by utilizing various information criteria (see Table 8). Estimated VAR (2) model is stable (see Figure 1 and Table 9), serially uncorrelated (see Table 10) and homoscedastic (see Table 11).

Table 4. *Toda-Yamamoto causality test results (Azerbaijan)*

H_0	χ^2	Prob.	Decision
GDP doesn't Granger-cause *OIL*.	4.627	0.098	*GDP* ⋯ *OIL*
USD doesn't Granger-cause *OIL*.	6.754	0.034	*USD* → *OIL*
OIL doesn't Granger-cause *GDP*.	17.29	0.000	*OIL* → *GDP*
USD doesn't Granger-cause *GDP*	3.388	0.183	*USD* ⋯ *GDP*
OIL doesn't Granger-cause *USD*.	1.588	0.452	*OIL* ⋯ *USD*
GDP doesn't Granger-cause *USD*.	6.823	0.033	*GDP* → *USD*

A → *B* means causality runs from *A* to *B*.
A ⋯ *B* means no causality between *A* and *B*.

To run TY causality test, VAR (4) model with $p+m_{max}=4$ lags is estimated and Wald test is applied on $p=2$ lags. With respect to the results presented on Table 4, null hypotheses of "*USD* doesn't Granger-cause *OIL*" and "*GDP* doesn't Granger-cause *USD*" are rejected at 5% level; null hypothesis "*OIL doesn't Granger-cause GDP*" is rejected at 1% level. Therefore, we decided that there are unidirectional causalities running from exchange rate to oil prices, from oil prices to GDP, and from GDP to exchange rate for Azerbaijan.

4.2. Results for Kazakhstan

ADF unit root tests, whose findings are presented on Table 5, show that unit root hypotheses are rejected at 1% level for every single variable in their first differences both for equations with constant and equations with constant and trend.

Table 5. *ADF unit root test results (Kazakhstan)*

	ADF (Constant)		ADF (Constant and trend)	
	Level	1st dif.	Level	1st dif.
OIL	-1.700	-9.072***	-1.349	-9.114***
GDP	-1.447	-9.512***	-0.814	-9.779***
USD	-0.170	-13.85***	-1.049	-13.10***

*** represents significance at 1% level. Lag length for ADF test is chosen by Schwarz Information Criteria.

Regarding the results from PP unit root tests presented on Table 6, *OIL* and *GDP* are stationary in their first differences both for equations with constant and for equations with constant and trend at 1% significance level. But, *USD* is found stationary in its level, both for equations with constant and equations with constant and trend at 1% significance. Despite these two tests give different results about the stationarity of *USD* variable, the maximum integration order is $m_{max}=1$. Therefore, 1 additional lag will be added to the VAR model.

Table 6. *PP unit root test results (Kazakhstan)*

	PP (Constant)		PP (Constant and trend)	
	Level	1st dif.	Level	1st dif.
OIL	-1.696	-9.073***	-1.418	-9.114***
GDP	-1.425	-9.623***	-1.002	-9.829***
USD	-5.665***	-	-6.800***	-

*** represents significance at 1% level. Barlett Kernel is used as the spectral estimation method and the bandwidth is determined using the Newey–West method.

Optimum lag length is found $p=4$ for the VAR model to be estimated by utilizing various information criteria (see Table 12). Estimated VAR (4) model is stable (see Figure 2 and Table 13) and serially uncorrelated (see Table 14). Even the residuals of the model suffer from heteroskedasticity at 5% level, they are homoscedastic at 1% level (see Table 15).

Table 7. *Toda-Yamamoto causality test results (Kazakhstan)*

H_0	χ^2	Prob.	Decision
GDP doesn't Granger-cause *OIL*.	2.696	0.609	*GDP* ··· *OIL*
USD doesn't Granger-cause *OIL*.	3.783	0.436	*USD* ··· *OIL*
OIL doesn't Granger-cause *GDP*.	38.99	0.000	*OIL* → *GDP*
USD doesn't Granger-cause *GDP*.	10.11	0.038	*USD* → *GDP*
OIL doesn't Granger-cause *USD*.	18.76	0.000	*OIL* → *USD*
GDP doesn't Granger-cause *USD*.	3.791	0.435	*GDP* ··· *USD*

A → *B* means causality runs from *A* to *B*.
A ··· *B* means no causality between *A* and *B*.

VAR (5) model with $p+m_{max}=5$ lags is estimated for TY causality test and Wald test is applied on $p=4$ lags. According to the results given on Table 7, null hypotheses of "*OIL* doesn't Granger-cause *GDP*" and "*OIL* doesn't Granger-cause *USD*" are rejected at 1% level; the null of "*USD* doesn't Granger-cause *GDP*" is rejected at 5% level. Therefore, we decide that there are unidirectional causalities running from oil prices to GDP, from exchange rate to GDP and oil prices to exchange rate for Kazakhstan.

CONCLUSIONS AND POLICY IMPLICATIONS

Azerbaijan and Kazakhstan are leading oil producers among Turkish republics in Central Asia and the Caucasus. But, best of our knowledge, there is no any special work on the causal relationship among oil prices, GDP and exchange rate for these important oil rich countries. Therefore, current paper contributes to literature by examining causal relationships between oil prices, GDP and exchange rate using quarterly time series data for Azerbaijan and Kazakhstan. Causality test developed by Toda et al. (1995) is utilized to reveal potential causalities. The findings give substantial clues for policy makers of related countries.

First of all, there is a one-way causality running from oil prices to GDP for both countries. This finding shows that the obstacles on oil price rises can adversely affect economic growth. In this regard, oil price rises are for the benefit of these two countries whose main export products are oil and its derivatives. This finding is parallel with the finding of Pradhan et al. (2015), Aliyu (2009), Akıncı et al. (2012) and Öksüzler et al. (2011).

There is a one-way causality running from oil prices to exchange rate for Kazakhstan. This finding indicates the sensitivity of exchange rate on oil prices. Studies finding similar results in the literature are Brahmasrene et al. (2014), Öztürk et al. (2008), Bénassy-Quéré et al. (2007), Amano et al. (1998) and Bal et al. (2015). However, the related causality runs from exchange rate to oil price for Azerbaijan. In this regard, Brahmasrene et al. (2014) state that there is no consensus on the dynamics between oil prices and the exchange rate, and that this may be due to exchange rate measurement, time-varying causality structures or other reasons. Their arguments suggest that the one-way causality running from exchange rate to oil prices can only explain that existing and previous information on exchange rates helps to develop oil price forecasts.

Unidirectional causality from GDP to exchange rate is detected for Azerbaijan. If the exchange rate is affected by economic growth, then the government may need to follow a stable exchange rate policy. But, this causality for Kazakhstan runs from exchange rate to GDP. In this regard, switching to free foreign exchange rate regime, which was made in August 2015, can be said is an appropriate move. As stated before, oil prices cause exchange rate. Therefore, higher oil prices trigger exchange rate, then the increased exchange rate will allow for higher economic growth rates.

Besides our results, in different studies, real values of the variables can be used and structural breaks can be taken into consideration.

APPENDIX

Table 8. *Lag Length Selection (Azerbaijan)*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	91.59415	NA	5.80e-06	-3.543766	-3.429045	-3.500080
1	284.2781	354.5385	3.74e-09	-10.89113	-10.43224	-10.71638
2	313.9856	51.09688*	1.64e-09*	-11.71943*	-10.91638*	-11.41362*
3	320.9694	11.17411	1.80e-09	-11.63878	-10.49156	-11.20191
4	329.7349	12.97291	1.85e-09	-11.62940	-10.13802	-11.06147

LogL: Log-likelihood
LR: sequential modified LR test statistic
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

* indicates lag order selected by the criterion.

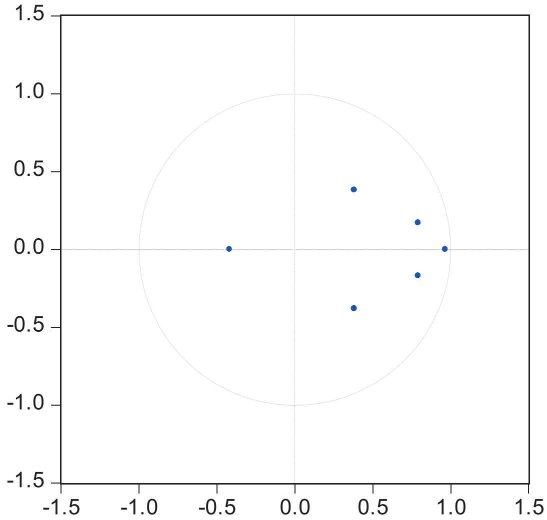

Figure *1*. Inverse roots of AR characteristic polynomial (Azerbaijan)

Table 9. *Roots of Characteristic Polynomial (Azerbaijan)*

Root	Modulus
0.966916	0.966916
0.792861 - 0.169626i	0.810803
0.792861 + 0.169626i	0.810803
0.381832 - 0.381277i	0.539600
0.381832 + 0.381277i	0.539600
-0.417192	0.417192
0.966916	0.966916
0.792861 - 0.169626i	0.810803
0.792861 + 0.169626i	0.810803

Table 10. *VAR Residual Serial Correlation LM Tests (Azerbaijan)*

Lags	LM-Stat	Prob.
1	13.11856	0.1573
2	13.05000	0.1604
3	14.34105	0.1107
4	9.104645	0.4277

Table 11. *VAR Residual Heteroskedasticity Test (Azerbaijan)*

Chi-sq	Prob.
87.66	0.101

Table 12. *Lag Length Selection (Kazakhstan)*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-120.6795	NA	0.004420	3.091988	3.181314	3.127802
1	251.2079	706.5862	5.08e-07	-5.980199	-5.622895	-5.836945
2	271.2828	36.63656	3.85e-07	-6.257069	-5.631787*	-6.006376*
3	279.8101	14.92279	3.91e-07	-6.245252	-5.351992	-5.887119
4	290.9641	18.68304*	3.72e-07*	-6.299103*	-5.137865	-5.833530
5	298.0951	11.40955	3.93e-07	-6.252378	-4.823162	-5.679364
6	304.8006	10.22582	4.21e-07	-6.195014	-4.497820	-5.514560
7	305.7014	1.306273	5.24e-07	-5.992536	-4.027364	-5.204642
8	308.9611	4.482102	6.17e-07	-5.849029	-3.615879	-4.953695

LogL: Log-likelihood
LR: sequential modified LR test statistic
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

* indicates lag order selected by the criterion.

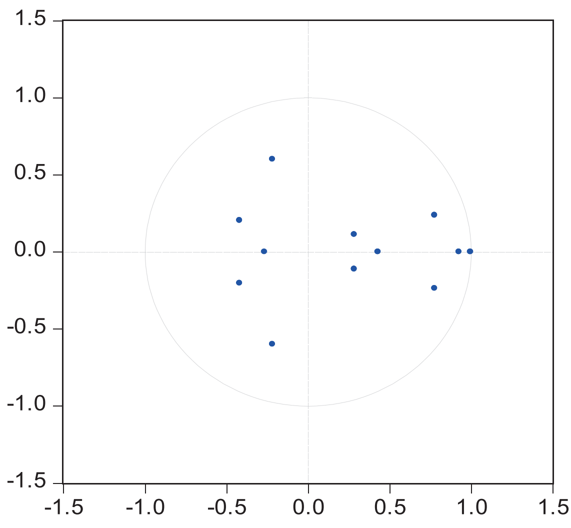

Figure 2. Inverse roots of AR characteristic polynomial (Kazakhstan)

Table 13. *Roots of Characteristic Polynomial (Kazakhstan)*

Root	Modulus
0.986073 - 0.127981i	0.994343
0.986073 + 0.127981i	0.994343
0.989885	0.989885
0.500681 - 0.486188i	0.697897
0.500681 + 0.486188i	0.697897
-0.570498	0.570498
-0.031052 - 0.537065i	0.537962
-0.031052 + 0.537065i	0.537962
-0.179513	0.179513

Table 14. *VAR Residual Serial Correlation LM Test (Kazakhstan)*

Lags	LM-Stat.	Prob.
1	11.76	0.226
2	14.24	0.113
3	16.73	0.053
4	16.75	0.052
5	7.020	0.635

Table 15: *VAR Residual Heteroskedasticity Tests (Kazakhstan)*

Chi-sq	Prob.
182.8	0.015

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Petrol Fiyatları, GSYİH ve Döviz Kuru Arasındaki Nedensellik: Azerbaycan ve Kazakistan Örneği*

Mehmet Dikkaya**
Bayram Veli Doyar***

Öz

Bağımsızlıklarının ardından petrol endüstrisine büyük önem atfeden Azerbaycan ve Kazakistan, bu endüstriye yabancı yatırımları da çekmeyi başarmıştır. Ekonomi için kilit rol üstlenen bu endüstri, ekonomiyi özellikle petrol fiyatlarına karşı hassas hale getirmiştir. Bu bağlamda, mevcut çalışmada hem Azerbaycan hem de Kazakistan için petrol fiyatı, GSYİH ve döviz kuru değişkenlerine ait çeyreklik zaman serileri arasındaki nedensellik ilişkileri ayrı ayrı incelenmektedir. Toda-Yamamoto nedensellik testi sonuçları, Azerbaycan için döviz kurundan petrol fiyatlarına, petrol fiyatlarından GSYİH'ya ve GSYİH'dan döviz kuruna işleyen tek yönlü nedenselliklere işaret ederken nedenselliklerin yönü Kazakistan için petrol fiyatlarından GSYİH'ya, döviz kurundan GSYİH'ya ve petrol fiyatlarından döviz kuruna şeklinde ortaya çıkmıştır.

Anahtar Kelimeler

Azerbaycan, Kazakistan, petrol fiyatları, GSYİH, döviz kuru, nedensellik

JEL Sınıflaması: C32, F31, Q43, F43

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** Prof. Dr., Kırıkkale Üniversitesi, Ekonomi Bölümü - Kırıkkale/Türkiye
mdikkaya@kku.edu.tr

*** Doktora Öğrencisi, Kırıkkale Üniversitesi, Ekonomi Bölümü - Kırıkkale/Türkiye
bvdoyar@gmail.com

Взаимосвязь нефтяных цен, ВВП и курса валют: на примере Азербайджана и Казахстана*

Мехмет Диккая**
Байрам Вели Дояр***

АННОТАЦИЯ

Азербайджан и Казахстан, в которых большое значение имеет нефтяная промышленность, после обретения независимости также удалось привлечь в эту отрасль иностранные инвестиции. Со временем эта отрасль, которая стала ключевой к экономике, сделала экономику уязвимойиз-за изменения цен на нефть.В связи с этим, настоящая статья исследует причинно-следственные связи между квартальными временными рядами цен на нефть, ВВП и обменным курсом для Азербайджана и Казахстана.Результаты испытаний причинности Тода-Ямамото для Азербайджана предполагают наличие однонаправленных причинно-следственных связей от обменного курса к ценам на нефть, от цен на нефть к ВВП и от ВВП к обменному курсу.Что касается Казахстана, то наблюдается взаимосвязь цен на нефть и ВВП, обменного курса и ВВП и цен на нефть по отношению к обменному курсу.

Ключевые слова

Азербайджан, Казахстан, цены на нефть, ВВП, обменный курс, взаимосвязь.

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** Проф.д-р., УниверситетКырыккале, кафедраэкономики - Кырыккале /Турция
mdikkaya@kku.edu.tr

*** Докторант, Университет Кырыккале, кафедра экономики - Кырыккале /Турция
bvdoyar@gmail.com